REMARKS

The following remarks are in response to the Final Office Action mailed October 1, 2002. Claims 1-16 and 28 remain pending. Applicants request entry of the above amendments, reconsideration of previous rejections, and allowance of all pending claims.

Before addressing the substantive rejections, Applicants note that PTO Form 1449, filed with an Information Disclosure statement received (as noted by stamped return postcard) by the PTO on March 6, 2002, has not been initialed and returned. Applicants remind the Examiner of MPEP 609.III.C(1):

> The examiner will inform applicant that the information has not been considered and the reasons why by using form paragraph 6.49 through 6.49.09.

Also, MPEP 609.III.C(2):

> The information contained in information disclosure statements which comply with both the content requirements of 37 CFR 1.98 and the requirements of, based on the time of filing the statement, of 37 CFR 1.97, will be considered by the examiner.

Applicants respectfully request that the IDS be considered and the associated PTO Form 1449 be returned, or that Applicants be notified of any deficiency. Applicants note that the PTO Form 1449 should at least have been returned with the previous Office Action, and note that by failing to promptly notify Applicants of any deficiency, Applicants, if a deficiency exists, will now be forced to resubmit the IDS, with additional fees. Therefore, if the Examiner finds any deficiency in the IDS, Applicants request that the finality of the previous rejection be withdrawn so that Applicants are not unfairly forced to file a request for continued examination to have the IDS considered.

In paragraph 2 of the Office Action, the Examiner rejected claims 1-7, 9-11 and 28 under 35 U.S.C. §103(a) as being unpatentable over Konno et al., U.S. Patent No. 5,089,732, in view of Weilbach et al., U.S. Patent No. 5,019,738.

Konno et al. disclose a spindle motor for use as a hard disk driver. Referring, as the Examiner does, to Figure 6, Konno et al. show a motor having a rotary member 6 having a columnar member 6b and a cylindrical rotating member 6a. Driving actuation is achieved by interaction between armature coils 5 and rotor magnet 8. A radial bearing includes a radial bearing sleeve 7 integrally formed with columnar member 6b and a radial bearing member 4 fixed to cylindrical support shaft 2.

The use of the outer cylindrical portion 6a by Konno et al., which is used to provide the magnetic actuation for the rotary motor, would impede air cooling of the cylindrical support shaft 2. Hence, the support shaft of Konno et al. would be subjected to at least the same, if not even greater, heating than the rotary member. The reason the heating may be greater is that there will be friction with the air on both the inside and the outside of the cylindrical support shaft 2. This would increase heating to an even greater extent, and so the cylindrical support shaft 2 may reach the same or even a higher temperature than the other portions of the motor.

Konno et al. also note the following:

> Since the thrust bearing can be readily preloaded by offsetting the longitudinal magnet center of the rotor magnet group from the longitudinal magnet center of the stator coil group by a predetermined distance in a counter direction to the dynamic pressure generated from the thrust bearing, no particular preloading means is needed.

Konno et al. at column 5, lines 1-7. Konno et al. note that this is an advantageous effect of the invention:

> (6) By offsetting the longitudinal magnetic center 8a of the rotor magnetic group from the longitudinal magnetic center 5a of the stator coil group by a predetermined distance in a direction away from the thrust bearing, the thrust bearing can be readily preloaded by the magnetic force acting between the rotor magnet group and the stator coil group without any particular preloading means.

Konno et al. at column 11, lines 38-45. This advantage is specifically claimed by Konno et al. in claims 3 and 4.

To achieve this offset effect across any temperature range, it would be necessary to carefully match the thermal expansion coefficients of the cylindrical support shaft 2 with that of the columnar member in order to preserve the distance of offset "d" (shown in Figure 1, but not in Figure 6). Note further that, for the embodiment of Figure 6 (cited by the Examiner), the magnet 8 on the rotating member would be subjected to a lower temperature because it is on the outside portion of the rotor 6.

Applicants' claim 1 recites that the material of the rotary member has a coefficient of thermal expansion that is smaller than that of the material of the fixed surface. Applying this restriction to Konno et al. would prevent the distance "d" of offset between the longitudinal centers of the magnets from being preserved. Indeed, applying this recitation to the structure of Konno et al. would exacerbate the problem of variations of "d" at higher temperatures.

Weilbach et al. note in several places that matching the coefficients of thermal expansion of the fixed and rotary parts of the motor is desirable. Although Weilbach et al. include at least one embodiment where the opposite effect is shown, the mere fact that Weilbach et al. illustrate such an embodiment does not change the fact that incorporation of that embodiment in the device of Konno et al. would abate one of the benefits of the invention of Konno et al.

In light of the above discussion, Applicants believe that there would be no reasonable expectation of success for the modifications of Konno et al. suggested by the Examiner in light

of Weilbach et al. However, a prima facie showing of obviousness requires a reasonable expectation of success. MPEP 2143.02. Therefore, Applicants believe that independent claim 1, and dependent claims 2-7, are clearly patentable over Konno et al. in view of Weilbach et al.

Independent claim 28 likewise recites that the materials for the rotary member and the fixed surface are selected in similar fashion to that of claim 1. Therefore, Applicants also believe that independent claim 28 is clearly patentable over Konno et al. in view of Weilbach et al.

Applicants have amended independent claim 9 to recite:

> 9. A motor provided in a turbo-molecular pump, comprising:
> a rotary shaft including a magnet;
> a bearing for radially supporting the rotary shaft, wherein the bearing includes:
> a cylindrical rotary member connected to the rotary shaft over the magnet; and
> a cylindrical fixed surface surrounding the rotary member, wherein the fixed surface is spaced from the rotary member by a predetermined distance, and wherein the rotary member is made of a material having a coefficient of thermal expansion that is $5x10^{-6}/°C$ or less; and
> armature coils arranged about a peripheral surface of the fixed surface to rotate the rotary shaft.

There are several structural differences between the device suggested by Konno et al. and that recited by the Applicants. As noted above, the cap-type structure of the rotor suggested by Konno et al. prevents cooling of the cylindrical support member 2 (see Figure 6). Konno et al. note repeatedly the advantages of providing a larger area for the radial bearing, for example, at column 4, lines 48-51. However, the solution provided by Konno et al. uses the cap-shaped rotor. A thrust bearing using the collar 6a of the rotor and elements 3 and 9 is used to provide additional stability to the motor during operation. This arrangement is espoused to provide advantage:

> (3) By disposing the thrust bearing at the outer periphery of the rotor, it is possible to increase both the diameter and area of the thrust bearing and hence

> obtain a high dynamic pressure. In addition, by magnetically preloading the thrust bearing in the thrust direction, the inclination of the support shaft with respect to the radial bearing is corrected and the rotor is capable of stably rotating without being sprung out by the dynamic pressure applied thereto in the thrust direction. In particular, even when the spindle motor is used in a horizontal position, the rotor rotates stably by virtue of the cooperation of the elongated radial bearing and the preload applied to the thrust bearing.

Konno et al. at column 11, lines 9-22.

Applicants, however, have recited placing the magnet beneath the cylindrical rotary member and the armature coils about the fixed surface. Hence the magnets interact across the gap of the radial bearing, rather than across an independent gap. This allows for a more compact design than that shown by Weilbach et al., for example, by reducing the length of the shaft. This also allows for a more compact design than that shown by Konno et al., by reducing the overall width of the device. Further, this improvement removes need for the outer cap of Konno et al., which reduces the rotational moment of the device and allows quicker angular acceleration up to operating speed.

The claim limitations of placing the cylindrical rotary member over the magnet and placing the armature coils about the fixed surface are not shown in any of the cited references. However, to establish a prima facie case of obviousness, all claim limitations must be taught or suggested. MPEP 2143.03. Therefore, Applicants believe that independent claim 9, and dependent claims 10 and 11, are clearly patentable over Konno et al. in view of Wielbach et al.

In paragraph 3 of the Final Action, the Examiner rejected claims 8 and 12 under 35 U.S.C. §103(a) as being unpatentable over Konno et al. in view of Weilbach et al. and further in view of Conrad, U.S. Patent No. 5,707,213.

As noted above with respect to claim 1, there would be no expectation of success for a proposed modification of Konno et al. in view of Weilbach et al. to satisfy the claim language of

claim 1. Conrad does not appear to provide any additional insight as to the difficulty of preserving the offset of the longitudinal centers of the magnets in Konno et al. Therefore, Applicants believe that dependent claim 8 is clearly patentable over Konno et al. in view of Weilbach et al. and Conrad.

Also, as noted above with respect to claim 9, the structural features of the claim are neither shown nor suggested by Konno et al. in view of Weilbach et al. Conrad does not even appear to illustrate a radial bearing of the type used by Konno et al. or Weilbach et al., as well as that recited by Applicants. Conrad does not provide additional insight as to the elements recited in claim 9 but missing in the cited art. Therefore, Applicants believe that dependent claim 12 is clearly patentable over Konno et al. in view of Weilbach et al. and Conrad.

In paragraph 4 of the Office Action, the Examiner rejected claims 13-16 under 35 U.S.C. §103(a) as being unpatentable over Konno et al. in view of Weilbach et al. and Yashiro, JP 2-16389.

Claims 13 and 15 both recite a turbo-molecular pump that includes a motor having a bearing including a rotary member and a fixed surface where the material of the rotary member has a coefficient of thermal expansion that is smaller than that of the material of the fixed surface. As noted above with respect to claim 1, modification of Konno et al. to include a rotary member having a coefficient of thermal expansion that is smaller than that of the fixed surface would lack a reasonable expectation of success. Yashiro does not appear to provide any additional suggestions that provide any reasonable expectation of success of the proposed modification, either. Therefore, Applicants believe that claims 13-16 are clearly patentable over Konno et al. in view of Weilbach et al. and Yashiro.

Reexamination and reconsideration are respectfully requested. It is respectfully submitted that all pending claims, namely claims 1-16 and 28, are now in condition for allowance. Issuance of a Notice of Allowance in due course is requested. If a telephone conference might be of assistance, please contact the undersigned attorney at (612) 677-9050.

Respectfully submitted,

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By their Attorney,

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Version with Markings to Show Changes Made

In the Claims:

Claims 9 and 28 have been amended as follows:

9. (Four Times Amended) A motor provided in a turbo-molecular pump, comprising:

a rotary shaft including a magnet; [and]

a bearing for radially supporting the rotary shaft, wherein the bearing includes:

a cylindrical rotary member connected to the rotary shaft over the magnet; and

a cylindrical fixed surface surrounding the rotary member, wherein the fixed surface is spaced from the rotary member by a predetermined distance, and wherein the rotary member is made of a material having a coefficient of thermal expansion that is $5x10^{-6}/°C$ or less; and

armature coils arranged about a peripheral surface of the fixed surface to rotate the rotary shaft.

28. (Once Amended) A method for producing a brushless motor of a turbo-molecular pump having a rotary shaft and an air bearing, wherein the air bearing includes a cylindrical rotary member connected to the rotary shaft, and a cylindrical fixed surface covering the [fixed surface] rotary shaft, the method comprising the step of:

selecting materials for the rotary member and the fixed surface [are selected] so that the material of the rotary member has a coefficient of thermal expansion that is smaller than that of the material of the fixed surface; and

assembling the rotary member and the fixed surface so that the fixed surface surrounds the rotary member and the fixed surface is spaced from the rotary member by a predetermined distance.